

What is claimed is:

1. A device insertable into a structure having a lumen comprising:
a first housing;
5 at least one functional element connected to the first housing, the functional element for use during a minimal access procedure; and
a securing element associated with the insertable device for removably securing the insertable device to or against a wall of a structure having a lumen.
- 10 2. The insertable device of claim 1, wherein the at least one functional element is movably connected to the first housing, the device comprising at least one actuating element connected to the first housing and the functional element, the actuating element capable of moving the functional element in relation to the first housing in at least one degree of freedom.
- 15 3. The insertable device of claim 1, wherein the securing element comprises a needle protruding from the insertable device essentially inline with an elongated axis of the device, a magnet, a clamp, and an adhesive.
- 20 4. The insertable device of claim 1, wherein the securing element comprises one of a magnet, a clamp, and an adhesive.
5. The insertable device of claim 1 adopted for use in connection with minimal access surgical procedures, wherein the securing element comprises a needle protruding from
25 the insertable device essentially inline with an elongated axis of the device, the insertable device capable therewith of being removably secured against a subject's abdominal wall by inserting the needle into tissue of the abdominal wall.
6. The insertable device of claim 1, wherein the functional element comprises a
30 camera element .
7. The insertable device of claim 6, wherein the camera element comprising one of a CMOS imaging sensor and a CCD image sensor

8. The insertable device of claim 1, wherein the functional element is a camera element comprising a lens and a CCD image sensor mounted in a lens housing having threads therein to accept the lens and to accommodate focal adjustments.

5 9. The insertable device of claim 1, wherein the at least one functional element is movably connected to the first housing, the device comprising at least one actuating element connected to the first housing and the functional element, the actuating element capable of moving the camera element in relation to the first housing in at least one degree of freedom selected from a group consisting of:

10 a first degree of rotational freedom essentially orthogonal to an elongated axis of the device;

a second degree of rotational freedom essentially inline with the elongated axis; and

a third degree of translation freedom essentially inline with the elongated axis.

15 10. The insertable device of claim 1, wherein the at least one functional element comprises a plurality of camera elements movably connected to the first housing, the device comprising a plurality of actuating element connected to the first housing and the camera elements, the actuating elements capable of moving each of the camera elements in relation to the first housing in at least one degree of freedom selected from the group consisting of:

20 a first degree of rotational freedom essentially orthogonal to an elongated axis of the device;

a second degree of rotational freedom essentially inline with the elongated axis; and

a third degree of translation freedom essentially inline with the elongated axis.

25 11. The insertable device of claim 1, wherein the at least one functional element is movably connected to the first housing, the device comprising at least one actuating element connected to the first housing and the functional element, the actuating element capable of moving the camera element in relation to the first housing in a first degree of rotational freedom essentially orthogonal to an elongated axis of the device allowing the functional
30 element to be retracted into and extracted from the first housing.

12. The insertable device of claim 11, wherein the actuating elements is a motor producing rotational movement that interfaces with the functional element to redirect the

rotational movement produced by the motor in a direction essentially orthogonal to the elongated axis.

13. The insertable device of claim 12, wherein the actuating element interfaces
5 with the functional element with a worm gear assembly.

14. The insertable device of claim 1, comprising a second housing rotatably
attached to the first housing and at least one actuating element connected to the first and
second housings, the actuating element thereby capable of moving the functional element in
10 relation to the first housing in a second degree of rotational freedom essentially inline to an
elongated axis of the device by rotating the first housing in relation to the second housing.

15. The insertable device of claim 1, wherein the at least one functional element is
movably connected to the first housing, the device comprising at least one actuating element
15 connected to the first housing and the functional element, the actuating element capable of
moving the functional element in relation to the first housing in a third degree of longitudinal
freedom essentially inline to an elongated axis of the device allowing the functional element
to translate along the third degree of freedom.

20 16. The insertable device of claim 15, comprising a shuttle capable of moving
along the elongated axis, wherein the functional element is mounted to the shuttle and the
actuating element is a motor producing rotational movement connected to a lead screw that
interfaces with a threaded portion of the shuttle to translate the rotational movement of the
motor into longitudinal movement in the shuttle along the elongated axis.

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17. The insertable device of claim 15, comprising a plurality of functional
elements, a corresponding number of motors producing rotational movement, and a
corresponding number of shuttles capable of moving along the elongated axis, each shuttle
comprising a threaded portion and a hole, wherein each functional element is mounted to a
30 shuttle, wherein each motor is connected to a lead screw that interfaces with the threaded
portion of one of the shuttles to translate the rotational movement of the motor into
longitudinal movement in the shuttle along the elongated axis, and wherein each lead screw
passes through the hole of another shuttle to provide a guide for the other shuttle.

18. The insertable device of claim 17, comprising at least one actuating element mounted onto each shuttle, the actuating element capable of moving the functional elements in relation to the first housing in a first degree of rotational freedom essentially orthogonal to the elongated axis allowing the functional elements to be retracted into and extracted from the first housing.

19. The insertable device of claim 18, wherein the plurality of actuating elements are capable of moving each of the functional elements independently of each other.

20. The insertable device of claim 1, comprising a second housing rotatably attached to the first housing and at least one actuating element connected to the first and second housings, the actuating element thereby capable of rotating the first housing in relation to the second housing, wherein each housing has an access opening therein capable of aligning with each other such that the first housing may be rotated to cover the functional elements and rotated to align the access openings to expose the functional element.

21. An device insertable into a structure having a lumen, the device comprising:
a first housing;
a second housing rotatably connected to the first housing;
at least one camera element comprising an image sensor movably connected to the first housing;
at least one actuating element connected to the first housing and the camera element, the actuating element capable of moving the camera element in relation to the first housing in at least one degree of freedom selected from a group consisting of:
a first degree of rotational freedom essentially orthogonal to an elongated axis of the device,
a second degree of rotational freedom essentially inline with the elongated axis, and
a third degree of longitudinal freedom essentially inline with the elongated axis; and
a securing element associated with the second housing for removably securing the device to or against a wall of a structure having a lumen.

22. An device insertable into a structure having a lumen, the device comprising:

a first housing;
a second housing rotatably connected to the first housing;
a plurality of camera elements each comprising an image sensor movably connected to the first housing;

5 at least one actuating element connected to the first housing and the second housing, the actuating element capable of rotating the first housing in relation to the second housing;

at least one actuating element connected to each of the camera elements, the actuating element capable of moving the camera element in relation to the first housing in a first degree of rotational freedom essentially orthogonal to an elongated axis of the device; and

10 a securing element associated with the second housing for removably securing the device to or against a wall of a structure with a lumen.

23. A minimal access system comprising a driving device communicatively connected at least one device insertable into a structure having a lumen, the insertable device
15 comprising:

at least one functional element for use during a minimal access procedure; and

at least one securing element for securing the insertable device against a wall of the structure having the lumen.

20 24. The system of claim 23, wherein the insertable device comprises at least one actuating element capable of moving the functional element in at least one degree of freedom, and the driving device provides a drive signal to remotely control the movement of the functional element.

25 25. The system of claim 24, wherein the driving device is adopted to provide hybrid control of the insertable device, wherein the driving device autonomously controls functional element movement in at least one degree of freedom.

26. The system of claim 24, wherein the functional element comprises a camera
30 element and the driving device autonomously controls camera element movement to maintain a user identified object in view while the user controls camera element movement in at least one degree of freedom to obtain an image of the site of interest from different perspectives.

27. The system of claim 24, wherein the at least one functional element comprises a plurality of camera elements and wherein the driving device autonomously controls the movement of the camera elements to produce a stereoscopic image of the site of interest.

5 28. The system of claim 27, wherein the driving device autonomously controls the camera elements to create stereo images of a site of interest in real-time based on automatic vergence algorithms.